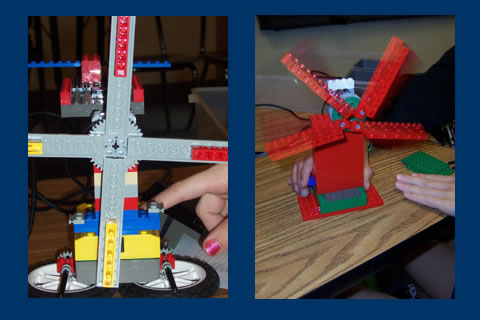
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GRIT687: Technology and the Administrator

Emergent Technology – Robotics in Education

A form of technology emerging in the field of education today is teaching robotics to students. From LEGOs, to more advanced wiring and software, using robotics within the classroom has proven to be a means of teaching students problem solving, decision making, goal setting, patience, and teamwork, not to mention basics in engineering, computer programming and design.

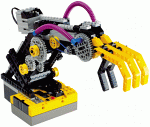
 Although when one hears the word *robotics,* they most likely think of *Star Wars*, or Rosie from *The Jetsons,* robotics does not have to involve life-size cyborgs. It simply refers to the “design, fabrication, theory, and application of robots,” (schoolcomputing.wikia.com) and robots being anything mechanical that does some sort of work. By definition, robotics has nothing to do with the exact size or sophistication of the robot, but that the process is followed. For example, to the right are two pictures of windmills created by elementary students through a robotics curriculum. Though basic, these students had to come up with a plan, test that plan, and then troubleshoot in order to make a working robot. Obviously, as students get older, their robots will become more sophisticated. The fact that students can create working robots leads to a higher level of engagement, which leads to a more valuable learning experience.

Another great part about using robotics in education is that it teaches problem solving. And not just how to solve an issue with their robot, like if their windmill doesn’t spin, but rather, how to solve potential real world issues. It is important for students to understand that inventions don’t occur simply because people are bored, but in order to solve a problem. Robotics Education can help students gain this realization, and there are many resources out there to support teachers with this. For example, the website <http://www.stager.org/lego/challenges.pdf> , which I is more appropriate for High School aged students, provides teachers with 15 challenges for students to solve using LEGO Robotic Kits. For example, one challenge reads “In the Fall of 1999, the Coca-Cola company announced that they would be commercially testing a soda machine that would charge thirsty patrons more for a can of soda on a hot day than on a cold day. Build a temperature sensitive vending machine that charges the user more money based on a hot day.” Prior to even building, this can lead to great discussion about how companies can maximize profit through creative inventions or innovations like this example.

It is important to note, that while many picture LEGOs as the interlocking blocks small children play with, the LEGO company has become one of the most popular resources for robotics curricula because they provide more advanced packages called the LEGO Mindstorm Series. The series, originally designed as a partnership between LEGO and MIT, includes, on top of the classic blocks, gears, pulleys, motors, touch sensors, light sensors, distance sensors, temperature sensors (that can detect from -20 to 50 degrees Fahrenheit) and wires. Plus, the RCX (Robotic Command eXplorer) package contains what is called a “programmable brick,” which is actually a small computer “containing 32K of RAM that stores firmware and user programs.” (Wikipedia.com) Using one of several available programming languages, students can upload a program to the brick, which will then control their robot. The brick can hold up to five programs at a time. Uploading these programs to the brick allows students to build devices that “turn, rotate, reverse directions, start and stop, respond to their environment, and execute other robotic functions, all controlled by the programed software.” (Microworlds.com)

LEGO Mindstorm programmable brick

Because of these advanced LEGO kits, Robotics Education is able to push students to whole new levels in the field, and explore many different types of real-world problems. For a better idea of what the Mindstorm Series looks like (and is capable of), here are a few pictures of robots created with them:

LEGO Mindstorms do not come cheap, however. A “team challenge set” costs $199.00 per team, while the “Roblab Starter Set” costs $330.00 per team. The basic “RCX Robotics Command Center” costs $121.99. You can also buy extra bricks ($26.25 each), individual touch sensors ($11.99), angle sensors (16.99), temperature sensors ($27.99), and light sensors ($18.99).

Not all Robotics Education involves fabricating robots with LEGOS, though. Some more sophisticated robotics curriculums involve giving students a task, and then asking them to use different materials to have the robot achieve that task. Students also work hard because they can compete against other teams from other schools to see which teams’ robot works most efficiently. For example, in the youtube video “Robots in Education: Technology Motivated Learning,” high school students were given the task to create a robot that would fit into an 18x18x18 inch cube that would pick up a racquet ball, place it in a crate, and then stack the crate at as high a level as the robot could. The students spoke not only about how the project pushed their fabrication and troubleshooting abilities, but also how they enjoyed themselves while working towards a larger goal. The students also recalled how finishing poorly in one competition actually proved to be a positive experience, because it allowed them to reflect back on their experience, and how to improve their design for their next competition. This is a great example of how an educational experience proved to teach an important life lesson. The video also explains the scientific process students experience through Robotics Education; Look at a problem, create a goal, make a design, fabricate, troubleshoot, learn from issues with the prototype, redesign, refabricate, etc.

In the video, the students’ teacher was sitting with them, and spoke positively of what Robotics Education can do for students: “The students were excited about building the robots, and they get inspired. With that inspiration, with that hook, you can do a lot of things. Mostly, engineering is working hard. If students can learn that at an early time period, you can get enthusiastic about it, and it’s going to go a long way when they dive into a career in either engineering, science, math, or technology. I saw these guys have a lot of late nights, a lot of problem solving, and a lot of *learning,* and *that’s* what engineering is about.” Their teacher is speaking about preparing students for STEM (Science, Technology, Engineering, Mathematics) careers, which is a direction our country, and the world, is moving in. Without proper STEM education, students may not be ready for the world they are about to enter into.

Robotics Education has become widely popular in the United States. So much so, in fact, that there is even now a National Robotics Education Foundation, a non-profit organization dedicated to robotics in education. Their website is a hub for educators to read about current news in the field, get project ideas, and find local competitions. There is even a spot where you can browse by state to find events, Robotics Education Centers, and robotics camps.

By teaching students how to analyze a problem, set goals, and design a plan to reach those goals, not to mention basics in computer programming and engineering for older students, Robotics Education is a fantastic way to help prepare students for careers beyond the classroom. Not to mention, students gain life-long skills like teamwork, patience, and creativity. Due to its many benefits, whether basic LEGO kits with elementary students, or RBX or more complicated kits with secondary students, room should be made in any districts’ curriculum for Robotics Education.

Resources

**The National Robotics Education Foundation Homepage**

<http://www.the-nref.org/default.home>

**Gary S. Stager, Support for Progressive Educators; Ordering LEGOS**

<http://www.stager.org/lego/orderinglego.html>

**School Computing- Robotics**

<http://schoolcomputing.wikia.com/wiki/Robotics>

**Wikipedia – LEGO Mindstorms**

<http://en.wikipedia.org/wiki/Lego_Mindstorms>

**YouTube – Robots in Education: Technology Motivated Learning**

<http://www.youtube.com/watch?v=wYqx3WOfkjE>

**YouTube – FANUC Robotics Engineer Jessica Beltran talks Robotics, STEM Education**

<http://www.youtube.com/watch?v=jQIH7rEf54k>

**MicroWorlds – LEGO RCX**

<http://www.microworlds.com/solutions/mwexroboticspage2.html>

**Pictures:**

<http://www.creativerobotics.com.my/products_intermediate.htm>

<http://wl.k12.in.us/cumberland/classrooms/brantleyd/lego_robotics.htm#Task_1>

<http://www.microworlds.com/solutions/mwexroboticspage2.html>

<http://www.marsnews.com/store/>